inside-out access
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access frenzy
central venous access: the most commonly performed hospital procedure
- catheters destroy veins
- veins treated like disposable conduits
- epidemic of central vein occlusion

the solution
stop the serial sacrifice of central veins
- you don’t need patent veins for central venous access

inside-out access
reversing the direction of puncture

case study 1
nonischemic cardiomyopathy requiring biventricular icd implant
- chronic, total svc > 10 years
- multiple recanalization attempts
- failed thoracotomy, bleeding
Case Study 1
NONISCHEMIC CARDIOMYOPATHY REQUIRING BIVENTRICULAR ICD IMPLANT

- Needle guide aimed at head of right clavicle
- Puncture with sharpened .018" needle-wire
- Needle exits skin

Why Inside-Out Works
CENTRAL VENOUS SYSTEM RECONSTRUCTED FROM CT

- The A-P fluoro view
- IVC, RA, SVC, BC, RIJ stacked
- Straight line from IVC to Right IJ
- This view limits understanding
- 3-D structure

Central Veins and the Thoracic Cage
ALIGNMENT OF VEINS AND PROXIMITY TO BONES OF THE CHEST WALL

- Right internal jugular joins right subclavian behind head of clavicle
- Straight line from IVC to clavicle
- Vein lies immediately adjacent to bone
- Head of clavicle is a key landmark
- Anterior boundary of upper thorax
- POINT OF SAFETY
- No visceral structures anterior to this point
- Distance to bone is surprisingly short

Proximity to Head of Clavicle
JUNCTION OF RIJ AND SUBCLAVIAN VEINS IS IN CONTACT WITH HEAD OF CLAVICLE

- Pull dilator/sheath into position
- Successful completion of a conventional device implant

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Relationship to Arteries
BRACHIOCEPHALIC, RIGHT SUBCLAVIAN, RIGHT CAROTID ARTERIES
- Arteries are always BEHIND veins
- Veins are always BEHIND bone
- Anterior needle path from head of clavicle is always safe

Case Study 2
SHORT BOWEL SYNDROME REQUIRING IV FLUIDS AND NUTRITION
- Central veins exhausted by repeat CVCs
- Multiple recanalization attempts
- Identify occlusion from below
- Plot trajectory to clavicle
- Puncture
- Pull
- Completion dual port

Case Study 3: Access Crisis
FAILED PERCUTANEOUS CATHETER PLACEMENT AND NEED FOR URGENT DIALYSIS
- Unable to re-establish any access
- Chronic SVC occlusion at RA
- Identify RA appendage (anterior)
- Identify SVC stump (posterior)
- Puncture to clavicle
- Successful TDC placement

Inside-Out Tools
PROCEDURE CURRENTLY REQUIRES IMPROVED HARDWARE
- Inside-Out Tools
- Diamond file
- Transseptal needle and dilator

Anyone Can Do This
THE INSIDE-OUT LEARNING CURVE IS SHORT

Inside-Out Tools
PROCEDURE CURRENTLY REQUIRES IMPROVED HARDWARE
- Inside-Out Tools
- Sharpened 0.18" needle wire
- Transseptal needle (used as directional guide)
- Transseptal dilator
- Direction pointer

Fluoro Time to Access
Mean 3.5 ± 4.1, Median 2.1 minutes

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Types of Occlusion

Majority of cases involve SVC occlusion

- SVC at RA: 14.4%
- SVC above azygos: 40.5%
- None: 1.3%
- IJ: 11.2%
- Brachiocephalic: 20.2%

Initial Experience

Despite relative complexity of cases and early learning phase

- More than 400 patients treated
- No complications
- No failures
- No cases declined

Types of Device

Inside-out compatible with any device

- Other tunneled: 4%
- Temp HD: 12%
- CIEDs: 17%
- Ports: 4%
- Other: 1%

Chronic HD access: 58%

Large Device Compatibility

Inside-out approach supports large diameter and multiple devices

- 19F Neero graft
- 31F Avalon cannula
- Cardio-pulmonary bypass

Repeat Inside-Out Access

This procedure can be repeated as many times as needed

- One procedure: 27%
- Two procedures: 17%
- Three procedures: 14%
- Four or more: 8%

We Can Save the Veins

Avoid the morbidity and risk of multiple central vein occlusions

- Stop the serial sacrifice of central veins
- Re-utilize occluded RIJ segments indefinitely
- NEVER place catheters:
  - Left IJ
  - Femoral
  - Subclavian

Specifications

- Inside-out
- Re-utilize occluded segments
- Any device
- Large diameter
- Multiple devices
If you were the patient... How many central vein segments would you be willing to give up?

Thank you!